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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of

Kenneth Boyd et al.

Serial No.: 10/707,368 Group Art Unit: 2128

Filed: December 09, 2003 Examiner: Thornwell, Kimberly A.

For: METHOD AND APPARATUS FOR CONTROLLING A VEHICLE COMPUTER MODEL IN AN AGGRESSIVE LIMIT-SEEKING MANNER

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July 23, 2007
Date

(Signature) Karen Hopf
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BRIEF ON APPEAL

Mail Stop Appeal Brief-Patents
Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

The following appeal brief is being submitted pursuant to the Notice of Appeal dated May 22 2007, for the above-identified application.

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I. Real Party in Interest

The real party in interest in this matter is FORD GLOBAL TECHNOLOGIES, INC., in Dearborn, Michigan, (hereinafter "FORD") and is the assignee of the present invention and application.

II. Related Appeals and Interferences

There are no other known appeals or interferences, which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

III. Status Of The Claims

Claims 1 through 9 are currently pending and stand under final rejection, from which this appeal is taken.

IV. Status Of Amendments

No claim amendments have been made subsequent to the final rejection dated February 22, 2007.

V. Summary Of Claimed Subject Matter

The present invention is directed to a system and method for operating a vehicle model in an aggressive or limit-seeking manner with an adaptive look ahead. The present invention allows a vehicle computer model to be driven near its limits to allow vehicle designers to assess the vehicle handling. The independent claims of the present invention require path information that comprises a road radius of curvature and a scale factor determination that includes the intended path radius of curvature. The claims can be mapped to the specification in accordance with Figures 2 through 7, beginning at paragraph [0022].

Independent claim 1 requires a simulation system (30) for simulating an operation of an automotive vehicle (50) comprising:

an input (34) providing vehicle information (44) and path information (42), an initial steering wheel input (54), and an initial look ahead point (58), wherein the path information comprises a road radius of curvature (R); (Figures 2 and 3, paragraphs [0022], [0026] and [0027])

a controller (38) having a vehicle computer model (40) therein, said controller (38) programmed to determine a curvature (R) of an intended path from the path information (42), determine a look ahead scale factor (46) as a function of the intended path radius of curvature (R), determine a revised look ahead point (58) as a function of the look ahead scale factor (46), determine a steering wheel angle input (54) to the computer model (40) by comparing the revised look ahead point (58) and the intended path, operate the computer model (40) with the steering wheel angle input (54), and generate an output (46) in response to the vehicle model and the initial steering wheel input.(Figures 2 and 3, paragraphs [0022-0025] and [0034-0036]).

Dependent claim 2 requires a system as recited in claim 1 wherein the look ahead scale factor is directly proportional to the radius of curvature of the intended path. (Paragraph [0034]).

Dependent claim 3 requires a system as recited in claim 1 wherein, during straight-line vehicle travel, the look ahead scale factor is about 62 percent of a predetermined maximum scale factor. (Paragraph [0034]).

Independent claim 4 requires a method of operating a vehicle computer model (40) having vehicle information (44) and path information (42) therein comprising:

determining a curvature of an intended path (120) from the path information, said path information including a road radius of curvature; (Figure 7, paragraph [0035]}

determining a look ahead scale factor as a function of the intended path curvature (124); (Figure 7, paragraph [0035])

determining a look ahead point as a function of the look ahead scale factor (126); (Figure 7, paragraph [0035])

determining a steering wheel angle input to the computer model by com paring the look ahead point and the intended path (134); and (Figure 7, paragraph [0035])

operating the computer model with the steering wheel angle input (120). (Figure 7, paragraph [0035]).

Dependent claim 5 requires a method as recited in claim 4 wherein, the look ahead scale factor is directly proportional to the curvature of the intended path. (Paragraph [0034]).

Dependent claim 6 requires a method as recited in claim 4 wherein, during straight-line vehicle travel, the look ahead scale factor is about 62 percent of a predetermined maximum scale factor. (Paragraph [0034]).

Independent claim 7 requires a method of operating a vehicle computer model having vehicle information and path information therein comprising:

providing an initial steering wheel angle (134); (Figure 7, paragraph [0036])

determining a curvature of an intended path from the path information, said path information including a road radius of curvature (120); (Figure 7, paragraph [0035])

determining a look ahead scale factor as a function of the intended path curvature (124); (Figure 7, paragraph [0035])

determining a look ahead point as a function of the look ahead scale factor (126); (Figure 7, paragraph [0035])

when the vehicle is not on target (128), determining a revised steering wheel angle input to the computer model by comparing the look ahead point and the intended path (134); (Figure 7, paragraph [0036])

operating the computer model with the revised steering wheel angle input (120); and (Figure 7, paragraph [0035])

when the vehicle is on target (128), maintaining the initial steering wheel angle (130). (Figure 7, Paragraph [0035]).

Dependent claim 8 requires a method as recited in claim 7 wherein the look ahead scale factor is directly proportional to the curvature of the intended path. (Paragraph [0034]).

Dependent claim 9 requires a method as recited in claim 7 wherein, during straight-line vehicle travel, the look ahead scale factor is about 62 percent of a predetermined maximum scale factor. (Paragraph [0034]).

VI. Grounds of Rejection to be Reviewed on Appeal

The following issue is presented in this appeal, which corresponds directly to the Examiner's final ground for rejection in the final Office Action dated April 22, 2007 and the Advisory Action dated May 15, 2007:

Whether claims 1-9 are patentable over Sharp et al., "Optimal Preview Car Steering Control", published in Vehicle System Dynamics, Volume 35, no. ICTAM, in 2001, in view of Peng et al., "Optimal Preview Control for Vehicle Lateral Guidance", California Partners for Advanced Transit and Highways 1991.

VII. Argument

(a) Independent Claims 1, 4 and 7 and claims that depend therefrom, namely claims 2-3, 5-6 and 8-9.

The Examiner indicated that it would have been obvious to modify the teachings of Sharp with the teachings of Peng in order to arrive at the invention as set forth in independent claims 1, 4 and 7. Applicant's respectfully assert that one skilled in the art would not look to combine the references as suggested by the Examiner.

The present invention is directed to a system and method for operating a vehicle model in an aggressive or limit-seeking manner with an adaptive look ahead. The independent claims of the present invention require the step of determining a look-ahead scale factor as a function of the intended path curvature. Further, the path information recited in each of the independent claims comprises a road radius of curvature. The present invention varies, or adapts, the look-ahead scale factor as a function of the road radius of curvature.

The Sharp reference is directed to an optimized model for three different steering control situations. The Sharp reference does not teach or suggest any variance as a function of the intended path curvature and in fact, its teachings are independent of the intended path curvature.

The variance in Sharp is directed to preview time and relies solely on vehicle speed. Sharp teaches modifying a preview time based upon the priority of variables that include attitude angle control, path tracking, and steering input. The Sharp reference teaches varying the preview time within any of the three models for anything other than vehicle speed. Sharp varies the preview time (page 10, second full paragraph), based on vehicle speed. When steering input is not a great concern, i.e., at slower vehicle speeds, the preview time is about 1 second. When steering input is a greater concern, the preview time is increased to 8 seconds. However, no variations of any kind are taught or suggested in the Sharp reference based on road radius curvature as claimed in the present invention. Further, it is respectfully asserted that because Sharp is concerned only with path tracking errors, the path radius of curvature is not a concern to its teachings.

The Examiner agreed that Sharp does not expressly disclose path information comprising a road radius of curvature, or the look-ahead scale factor being a function of the intended path radius of curvature. However, in the final Office Action, the Examiner asserted that the Peng reference discloses a method for controlling a vehicle using an optimal preview control algorithm and that Peng teaches the input having path information containing a radius of curvature. The Examiner further asserts that the Peng reference teaches determining a look-ahead scale factor as a function of the intended path radius of curvature. The Examiner concludes that it would have been obvious to modify Sharp's method with Peng's use of the radius of curvature and that the motivation to do so would be to reduce error in calculating preview data by taking into consideration changes in road curvature.

Applicant's respectfully traverse. It is respectfully asserted that the teachings of Sharp are specifically independent of the path characteristics and that there is no motivation to combine the Sharp reference with such a reference. The Sharp reference is directed to a study of driver preview time as a function of travel speed for path error minimization. It is not directed to, nor does it concern itself with any variation that is a function of the intended path curvature as claimed in the present invention. Therefore, no motivation exists to combine the teachings of Sharp with a reference that discloses variation as a function of the intended path curvature.

According to the teachings of Sharp, only vehicle speed, as it related to preview time as a function of attitude control, path tracking, and steering input was studied by Sharp. Further, the preview time taught in Sharp is varied within any given model based only on vehicle speed and is independent of path curvature. Sharp teaches that path tracking control systems require varying

preview times based only on vehicle speed. For example, if steering input accuracy is a concern, then a very long preview time is required for a vehicle traveling at high speeds.

It is respectfully asserted that Sharp teaches that when a path tracking control scheme is desired, one must choose which type of error correction to emphasize in order to determine a preview time for accurate path tracking. It is respectfully asserted that Sharp teaches path tracking error and its teachings are independent of the characteristics of the path itself.

It is respectfully asserted that no motivation to include road radius of curvature in the control scheme of the Sharp reference exists. For this reason, it is respectfully requested that the rejections under 35 U.S.C. §103 be withdrawn and a Notice of Allowance is earnestly solicited.

VIII. Claims Appendix

A copy of the claims involved in this appeal, namely claims 1-9, is attached hereto as a Claims Appendix.

IX. Evidence Appendix

None

X. Related Proceedings Appendix

None

XI. Conclusion

For the reasons advanced above, Appellants respectfully contend that each claim is patentable. Therefore reversal of the rejection of claims 1 through 9, and Notice of Allowance thereof are requested.

Respectfully submitted,

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CLAIMS APPENDIX

1. (Rejected) A simulation system for simulating an operation of an automotive vehicle comprising:

an input providing vehicle information and path information, an initial steering wheel input, and an initial look ahead point, wherein the path information comprises a road radius of curvature;

a controller having a vehicle computer model therein, said controller programmed to determine a curvature of an intended path from the path information, determine a look ahead scale factor as a function of the intended path radius of curvature, determine a revised look ahead point as a function of the look ahead scale factor, determine a steering wheel angle input to the computer model by comparing the revised look ahead point and the intended path, operate the computer model with the steering wheel angle input, and generate an output in response to the vehicle model and the initial steering wheel input.

2. (Rejected) A system as recited in claim 1 wherein the look ahead scale factor is directly proportional to the radius of curvature of the intended path.

3. (Rejected) A system as recited in claim 1 wherein, during straight-line vehicle travel, the look ahead scale factor is about 62 percent of a predetermined maximum scale factor.

4. (Rejected) A method of operating a vehicle computer model having vehicle information and path information therein comprising:

determining a curvature of an intended path from the path information, said path information including a road radius of curvature;

determining a look ahead scale factor as a function of the intended path curvature;

determining a look ahead point as a function of the look ahead scale factor;

determining a steering wheel angle input to the computer model by comparing the look ahead point and the intended path; and

operating the computer model with the steering wheel angle input.

5. (Rejected) A method as recited in claim 4 wherein the look ahead scale factor is directly proportional to the curvature of the intended path.

6. (Rejected) A method as recited in claim 4 wherein, during straight-line vehicle travel, the look ahead scale factor is about 62 percent of a predetermined maximum scale factor.

7. (Rejected) A method of operating a vehicle computer model having vehicle information and path information therein comprising:

providing an initial steering wheel angle;

determining a curvature of an intended path from the path information, said path information including a road radius of curvature;

determining a look ahead scale factor as a function of the intended path curvature;

determining a look ahead point as a function of the look ahead scale factor;

when the vehicle is not on target, determining a revised steering wheel angle input to the computer model by comparing the look ahead point and the intended path;

operating the computer model with the revised steering wheel angle input; and

when the vehicle is on target, maintaining the initial steering wheel angle.

8. (Rejected) A method as recited in claim 7 wherein the look ahead scale factor is directly proportional to the curvature of the intended path.

9. (Rejected) A method as recited in claim 7 wherein, during straight-line vehicle travel, the look ahead scale factor is about 62 percent of a predetermined maximum scale factor.

EVIDENCE APPENDIX

No submitted or related evidence.

RELATED PROCEEDINGS APPENDIX

No related proceedings